

CLAIMS

1. An exhaust gas treatment apparatus placed in an exhaust system of a combustion gas and used for collecting and removing particulate matter contained in an exhaust gas, the treatment

5 apparatus characterized by comprising:

a casing connected to the exhaust system to serve as a main flow path of the exhaust gas; a honeycomb filter placed in the inside of the casing in such a manner that interrupts the main flow path, the honeycomb filter having a plurality of cells partitioned  
10 by partition walls to serve as filter flow paths of the exhaust gas and collecting the particulate matter contained in the exhaust gas; and plasma generation electrodes composed of a pulse electrode and an earth electrode placed being faced each other by sandwiching the honeycomb filter there, the plasma generation electrodes being  
15 capable of generating nonthermal plasma between the pulse electrode and the earth electrode,

wherein the particulate matter contained in the exhaust gas flowing into the casing is collected by the honeycomb filter, nitrogen monoxide contained in the exhaust gas is oxidized to  
20 nitrogen dioxide by the nonthermal plasma generated between the pulse electrode and the earth electrode constituting the plasma generation electrodes, combustible materials in the particulate matter collected and deposited on the surface of the partition walls are removed through oxidation by the nitrogen dioxide  
25 produced and, thereby the honeycomb filter can be regenerated.

2. An exhaust gas treatment apparatus placed in an exhaust system

of a combustion gas and used for collecting and removing particulate matter contained in an exhaust gas, the treatment apparatus characterized by comprising:

5 a casing connected to the exhaust system to serve as a main flow path of the exhaust gas; a honeycomb filter placed in the inside of the casing in such a manner that interrupts the main flow path, the honeycomb filter having a plurality of cells partitioned by partition walls to serve as filter flow paths of the exhaust gas and collecting the particulate matter contained in the exhaust gas;  
10 and plasma generation electrodes composed of a pulse electrode and an earth electrode placed in such a manner that at least one of them is in contact with the honeycomb filter, the plasma generation electrodes being capable of generating nonthermal plasma between the pulse electrode and the earth electrode,

15 wherein the particulate matter contained in the exhaust gas flowing into the casing is collected by the honeycomb filter, nitrogen monoxide contained in the exhaust gas is oxidized to nitrogen dioxide by the nonthermal plasma generated between the pulse electrode and the earth electrode constituting the plasma  
20 generation electrodes, combustible materials in the particulate matter collected and deposited on the surface of the partition walls are removed through oxidation by the nitrogen dioxide produced and, thereby, the honeycomb filter can be regenerated.

3. The exhaust gas treatment apparatus according to Claim 1 or  
25 Claim 2, further comprising a power source to apply a voltage to the pulse electrode.

4. The exhaust gas treatment apparatus according to any one of Claims 1 to 3, wherein the plasma generation electrodes are placed on outer perimeter surfaces of the honeycomb filter by a printing method through the use of a metal paste.

5 5. The exhaust gas treatment apparatus according to any one of Claims 1 to 4, wherein the material for the honeycomb filter comprises at least one material selected from the group consisting of cordierite, silicon carbide, SIALON, and silicon nitride.

10 6. The exhaust gas treatment apparatus according to any one of Claims 1 to 5, wherein the cell density of the honeycomb filter is 15 to 60 cells/cm<sup>2</sup>, the thickness of the partition wall is 0.2 to 0.5 mm, and the depth of plugging of the cell at end surfaces of the honeycomb filter is 1 to 20 mm.

15 7. The exhaust gas treatment apparatus according to any one of Claims 1 to 6, further comprising a dehydration device on the upstream side of the exhaust system of the casing in order to remove water contained in at least a part of the exhaust gas flowing into the casing.

20 8. The exhaust gas treatment apparatus according to any one of Claims 1 to 7, wherein a catalyst is held on the surface and/or in the inside of the partition walls of the honeycomb filter.

9. The exhaust gas treatment apparatus according to any one of Claims 1 to 8, further comprising a NO<sub>x</sub> treatment device on the downstream side of the exhaust system of the casing.

25 10. The exhaust gas treatment apparatus according to any one of Claims 3 to 9, wherein a current supplied from the power source is

a direct current with a voltage of at least 1 kV, a pulsed current with a peak voltage of at least 1 kV and the number of pulses of at least 1 per second, an alternating current with a peak voltage of at least 1 kV and a frequency of at least 1, or a current produced  
5 by superimposition of any two of them.

11. The exhaust gas treatment apparatus according to any one of Claims 1 to 10, placed in an exhaust system of a combustion gas of a diesel engine.